

Introduction

The hemispheric asymmetry model for encoding/retrieval (HERA), (Cabeza et al., 2003; Habib et al., 2003; Nyberg et al., 1996; Tulving et al., 1994) proposes a lateralization during memory process. With a preferential activity of the prefrontal cortex (PFC) in the left hemisphere during encoding and preferential activity of the PFC in the right hemisphere during retrieval. It has been shown that listening to music generates a greater activation of the right hemisphere (Alluri et al., 2013; Bever & Chiarello, 2009; Ono et al., 2011; Santosa et al., 2014). Therefore, an indirect method to evaluate lateralization consists of generating a competition for the resources on the hemisphere involved in the memory process (Friedman & Polson, 1981; Funahashi, 2017). The aim of this study is to validate a new procedure to indirectly study hemispheric activation. We hypothesize that: Listening to music during retrieval of verbal stimuli would lead to a decrease in performance compared to listening to music only at encoding, since in the first case the right hemisphere would be engaged in both tasks.

Method

Subjects

29 healthy right-handed subjects (score of +80th percentile in right hand on the Edinburgh Handedness Inventory; Oldfield, 1971), with normal or adjusted-to-normal vision and audition. Between 18-40 year, (M:28.76 SD:6) undergraduate or graduate students and without musical training.

Stimuli

Verbal stimuli: denomination of the 25 images taken from the Snodgrass & Vanderwart 'Like' Objects set (Rossion & Pourtois, 2004).

Musical stimuli: "Green Onions" by "Booker G and the MT's". (Alluri et al., 2013)

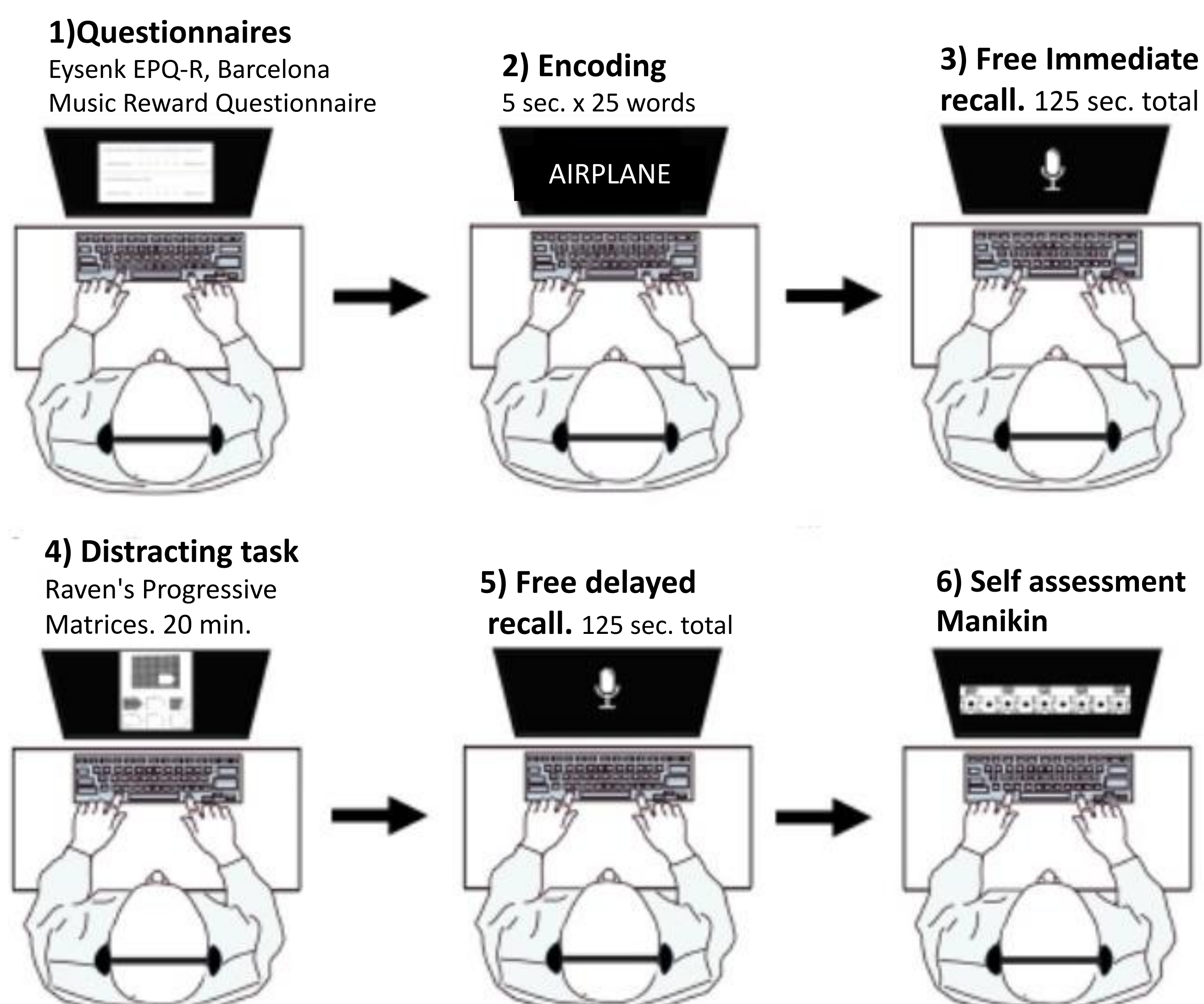
Data análisis

The SPSS 21 statistical package was used. Data of the experiment were analysed using mixed models of ANOVA, where the between-subject factor was determined by the experimental treatment (EM vs RM vs CG), and the intrasubject factor by the memory task (immediate and delayed free recall).

General Procedures

The experimental tasks were programmed in PsychoPy 2021.1.2 (Pierce, 2007). All instances of the experiment were carried out virtually and through each subject's computer.

The whole procedure is divided into three stages: Encoding, Immediate free recall, and Delayed free recall. Consists of three conditions: (1) Encoding with music - immediate and delayed free recall without music (EM), (2) Encoding and immediate free recall without music - delayed recall with music. (RM) (3) Encoding, immediate and delayed free recall without music (CG Control group).



Preliminary results

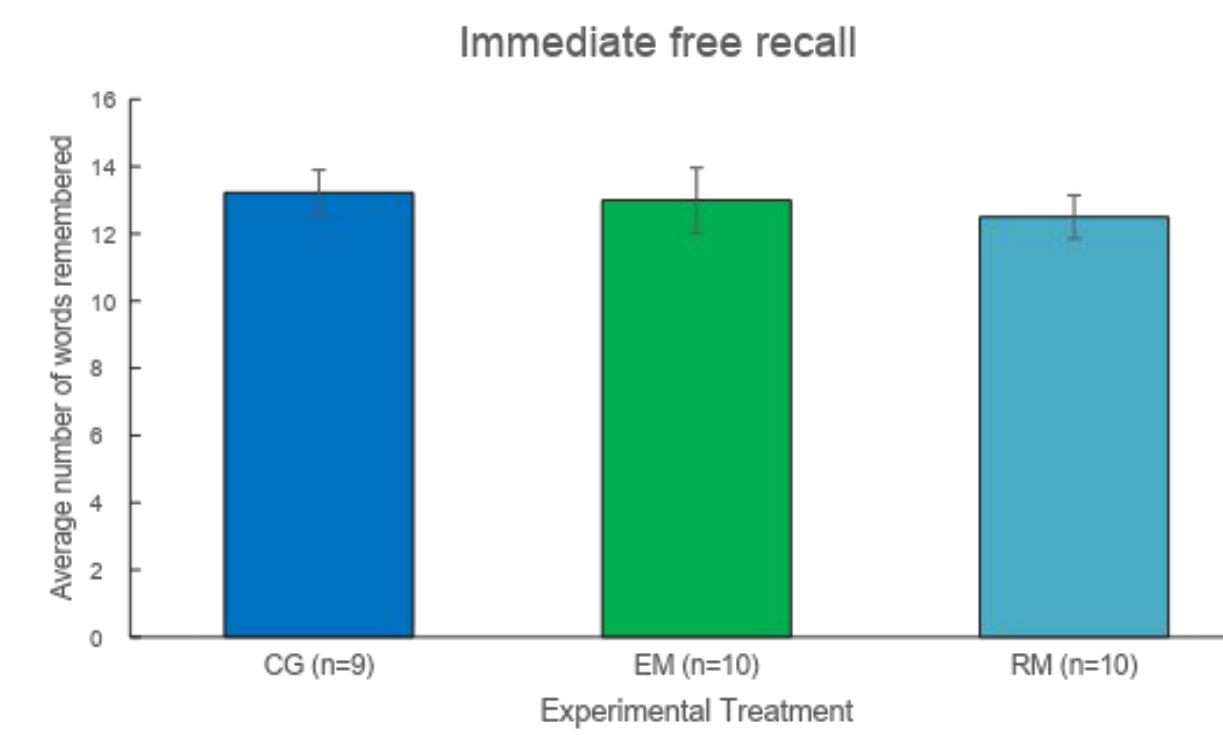


Fig. 1 During the immediate free recall, all groups showed a similar performance. The ANOVA one way showed no significant main effect of experimental treatment, $F(2, 26) = 0.116, p = .891, \eta^2_p = .009$.

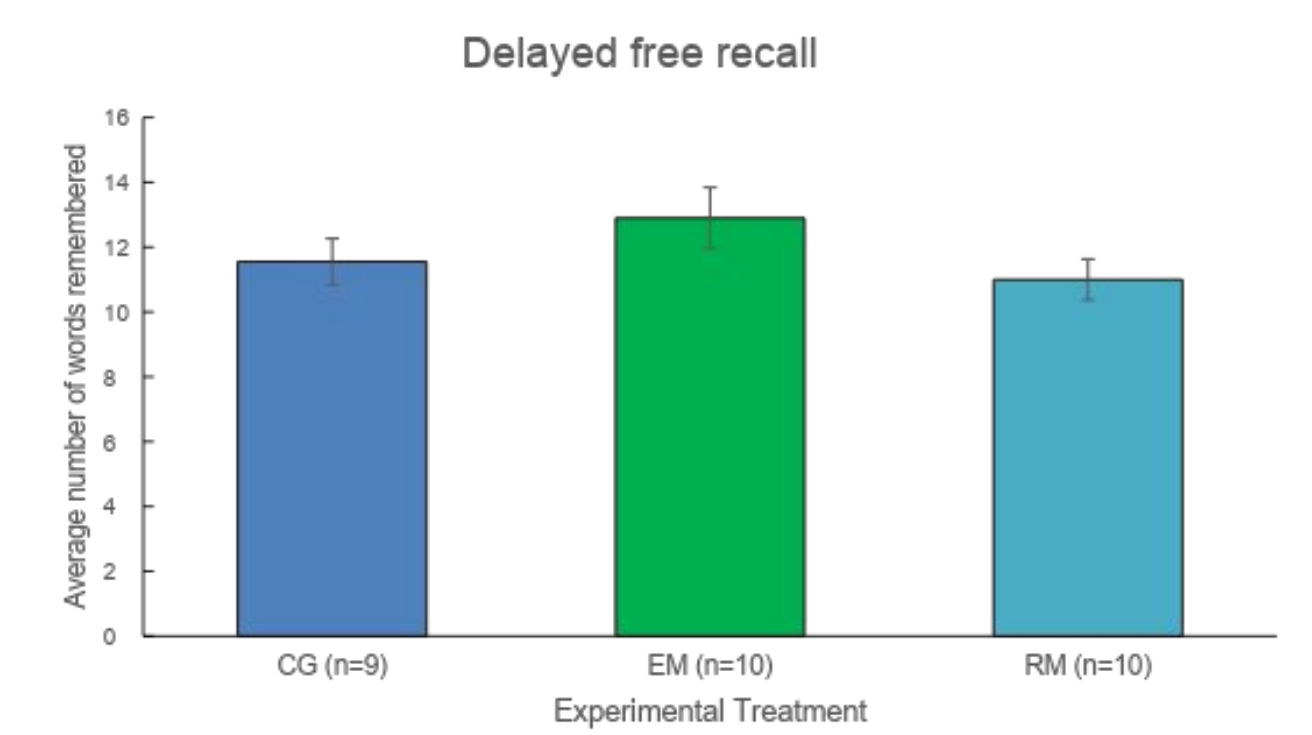


Fig 2. During the delayed free recall, all groups showed a similar performance. The ANOVA one way showed no significant main effect of experimental treatment, $F(2, 26) = 0.720, p = .496, \eta^2_p = .05$.

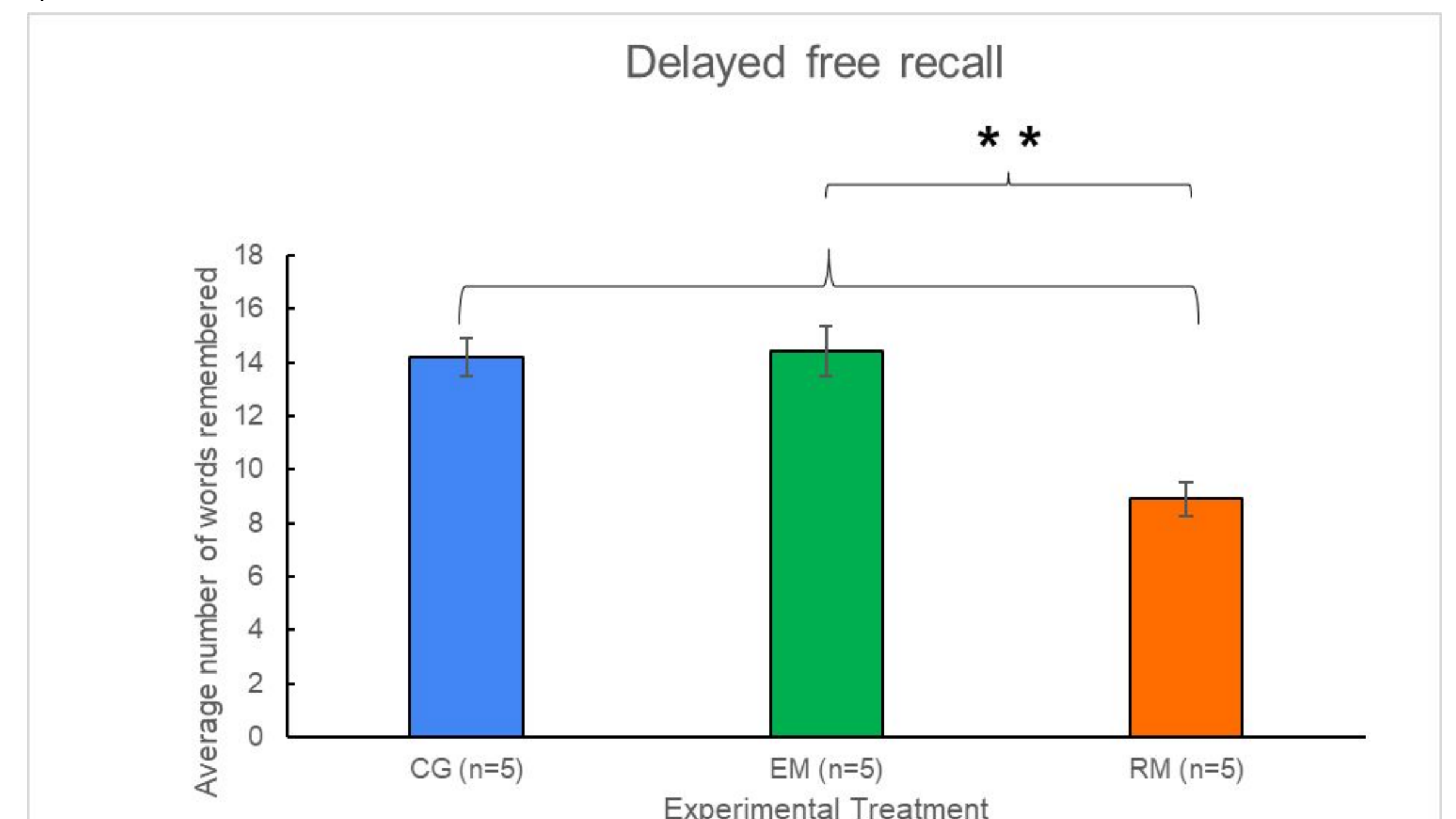


Fig. 3 Taking only those subjects who scored as highly arousing on the Self Assessment Manikin in the experimental treatment RM, we found a marginally significant effect between the conditions for delayed free recall (see Fig. 3). The ANOVA one way showed significant main effect of experimental treatment on delayed recall $F(2, 12) = 7.02, p = .01, \eta^2_p = .539$. The CG (n = 5) and EM (n = 5) groups had a greater performance than that of the RM (n = 5) group.

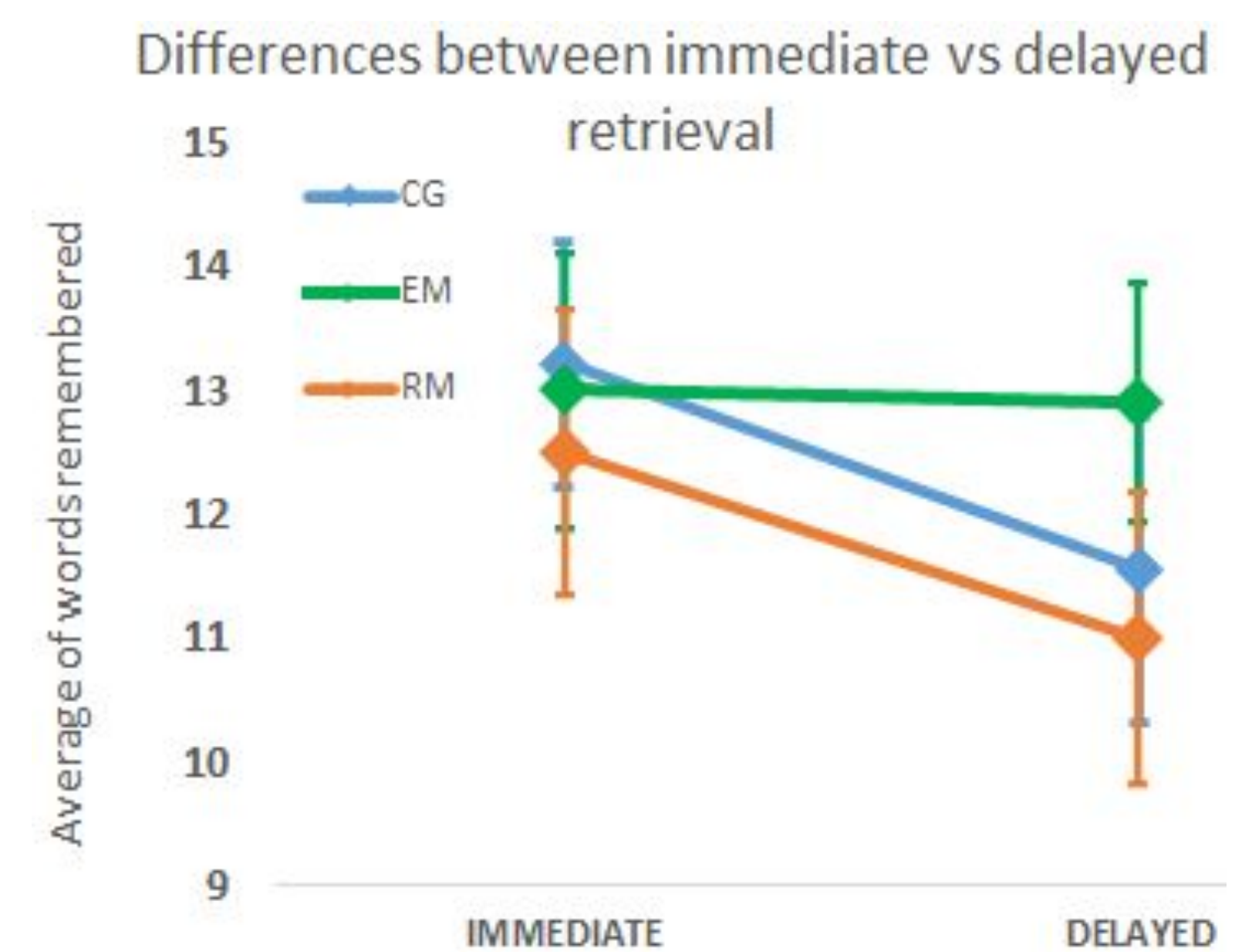


Fig 4. The analysis show no significant main effect of experimental treatment, $F(2, 26) = .305, p > .74, \eta^2_p = .023$ and significant main effect of memory task (immediate and delayed recall) $F(1, 26) = 18.81, p > .001, \eta^2_p = .420$ and the interaction memory task x experimental treatment, $F(2, 26) = 3.96, p < .031, \eta^2_p = .234$. The pairwise comparison test explored the differences between the groups in each memory task. In the CG ($p = .002$) and MR ($p = .001$) conditions, a lower performance in delayed free recall compared to immediate free recall was found. The EM group showed no differences between the two memory tasks ($p = .817$) (see Fig. 3).

Discussion

Our preliminary results showed no significant differences between the groups so far. Nevertheless, it is important to highlight that the subjects "n" for this poster presentation is still very small to venture any strong conclusions.

Interestingly, when we only analyze those subjects (5) who scored the music as highly arousing in the RM (Retrieval with music) experimental treatment (and pair them with 5 subjects matching sex and age from the other two groups), we found a statistically significant effect. These findings are consistent with previous literature (Cassidy & MacDonald, 2007; Nguyen & Grahn, 2017) reporting that high arousal music negatively affects performance on cognitive tasks.

Finally, the fact that the EM (encoding with music) experimental treatment retrieved fewer words between immediate and delayed recall, is also consistent with previous literature (Balch & Lewis, 1996; Ferreri, et. al., 2015; Isarida et al., 2017; Mead & Ball, 2007; Smith, 1985) showing a positive impact of music on information encoding and does not contradict the hypotheses proposed in the present study.

The fact that subjects who retrieved verbal information with music (RM) perform worse than the other two conditions may indicate the presence of the effect predicted by our hypotheses, but this would only occur with subjects who rate the piece of music used as high arousal.

It is important to point out that the sample size presented is small. Therefore, the previous statements should be taken with caution and re-examined once the proposed number of subjects (N=20 per condition) has been reached and white noise experimental treatment are taken for auditory stimulation control.